

Blockchain – energy sector solution

Department of Energy



Blockchain enables solutions not previously possible. It is perceived to be a transformative technology.

What is blockchain?

- ▶ A blockchain is a digital, secure public record book of **transactions** (or a ledger)
- ▶ A “block” is the way a **ledger** organises transactions into **blocks of data**
- ▶ The blocks link into a **sequence** that cannot be changed and is shared with everyone in the network.
- ▶ The network and data is **distributed**. There is no one single controlling authority. The data is shared across the network, protecting against illegal transactions.

Blockchain creates trust in data

- ▶ **Who’s who?** - Identity is established using digital signatures with public and private keys
- ▶ **Who owns what?** – Ownership is established using “cryptographic hashing” data stored in short form on the block. If attempts are made to change it, the system rejects it
- ▶ **What’s true?** – Transactions are verified using distributed consensus mechanisms.

TRACEABILITY

Event monitoring and asset or product tracking in secure environment

AUDITABLE

Provides full audit trail of data capturing all transactions

VALUE TRANSFER

Real-time rule based verification by multi-party confirmations

BUSINESS LOGIC

Smart contracts used for transactions, establishing ownership, measuring impact and task automation

Unique capabilities of Blockchain

IMMUTABLE

Validated, single, timestamped, tamper-proof data

TRUSTED INTERACTION

Trusted digital signature based peer to peer interactions

COMPLIANCE

Evidence of regulatory conditions compliance

STAKEHOLDER

P2P Communications, risk reduction, lower costs and trust between all parties



How does Blockchain work?

What does Blockchain work?



Hash

Block

Chain of Blocks

Distributed

Token

Coin base

Hash



Data:	Understanding Blockchain Technology in Energy
Hash:	3047c76e1a05c7bdf7aecd35d4a1be98bf806fe1ad556122c6ab3d42f47c63e

SHA-2 (Secure Hash Algorithm 2) is a set of cryptographic hash functions designed by the United States National Security Agency (NSA). They are built using the Merkle–Damgård structure, from a one-way compression function itself built using the Davies–Meyer structure from a (classified) specialized block cipher.

Block

Block:	# 1
Nonce:	29699
Data:	Understanding Blockchain Technology in Energy
Hash:	0000f15fdeb17bbda3d16b4f1d6f1922676fa9724ff5aa129935bbb8a7753f3f

Mine

Chain of Blocks



Breaking the Chain of Blocks

Block: # 3

Nonce: 41973

Data: What is Blockchain?

Prev: 0000497a3fc07ab29e468ab63c6429e1bc74e96f2f79b828572207659abcb5fd

Hash: 000022d1b2384807255cf154c89ffc36681524984ea65b4e5a068031905e86a7

Mine

Block: # 3

Nonce: 41973

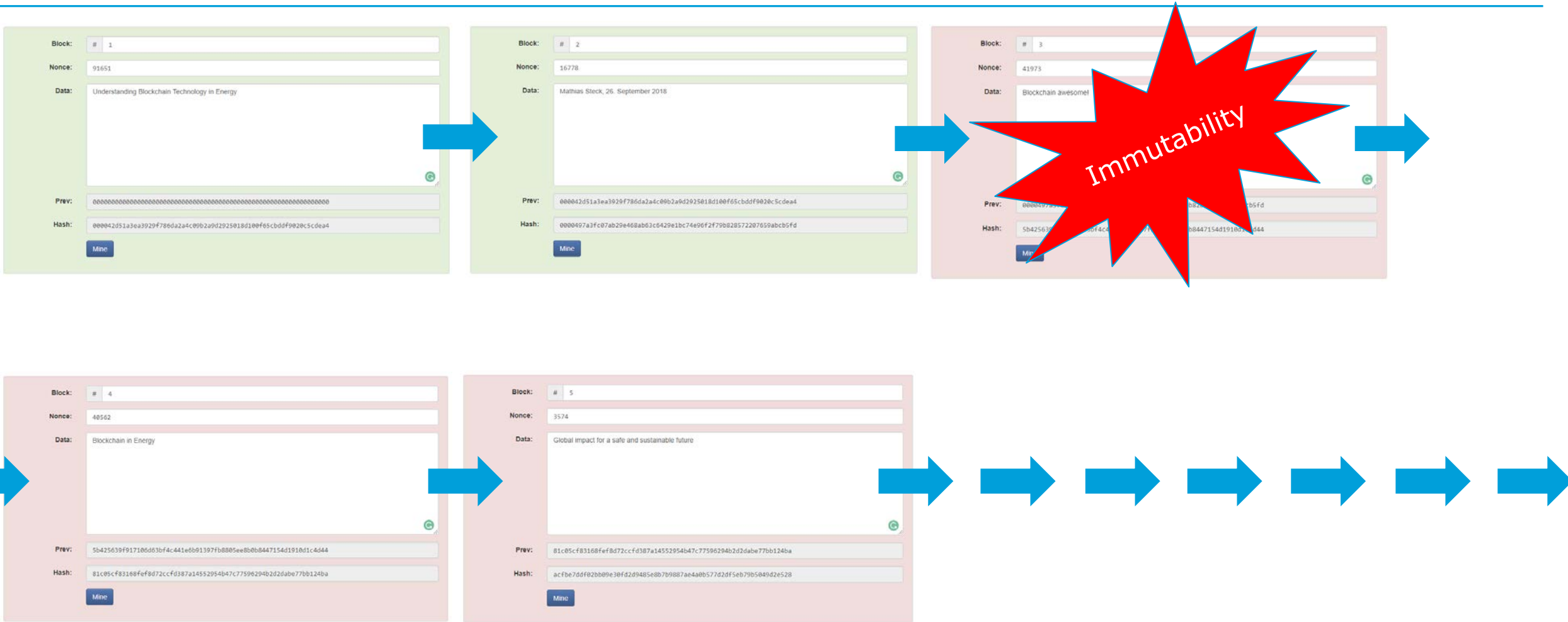
Data: Blockchain awesome!

Prev: 0000497a3fc07ab29e468ab63c6429e1bc74e96f2f79b828572207659abcb5fd

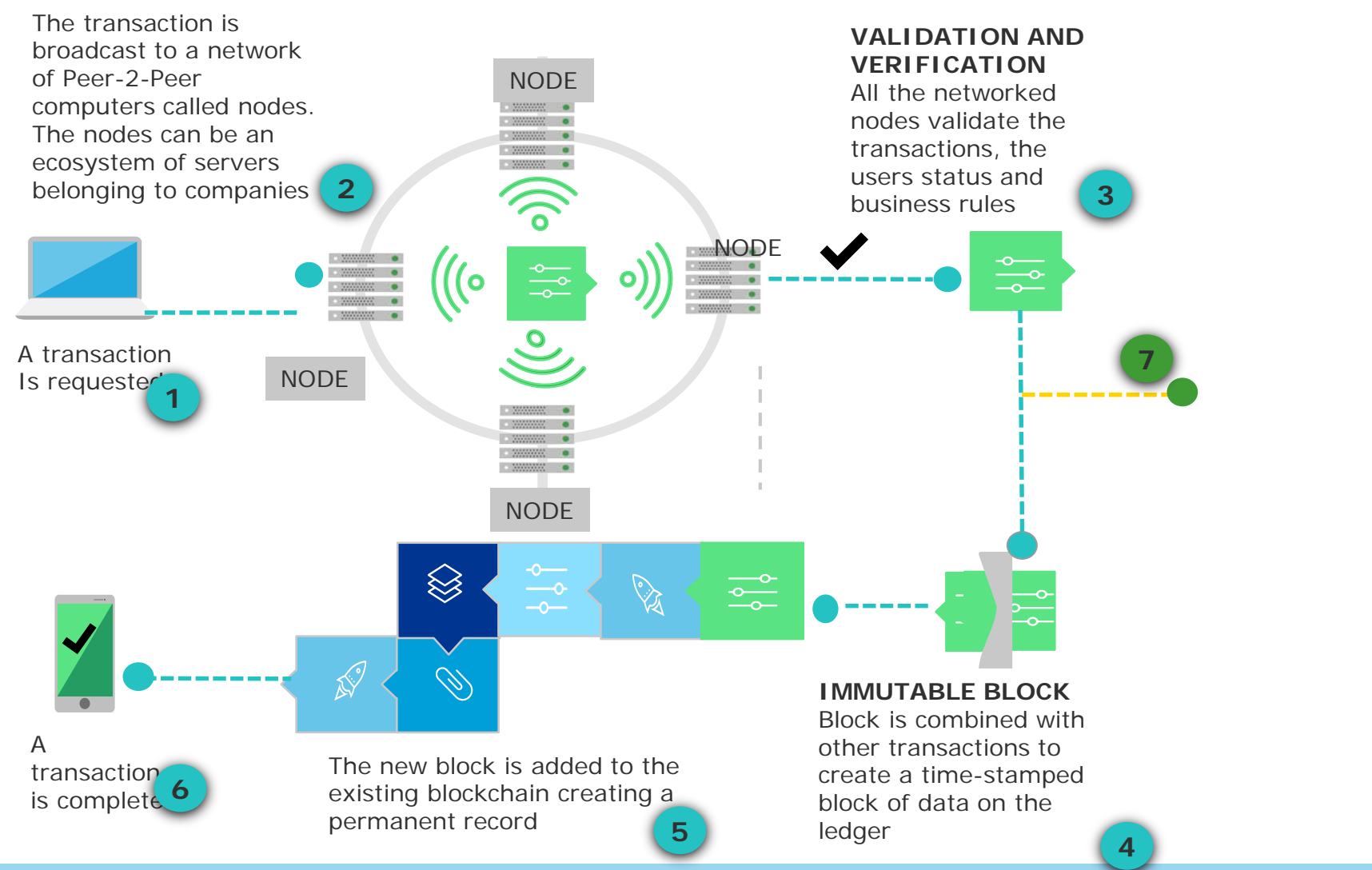
Hash: 5b425639f917106d63bf4c441e6b91397fb8805ee8b0b8447154d1910d1c4d44

Mine

Broken Chain of Blocks

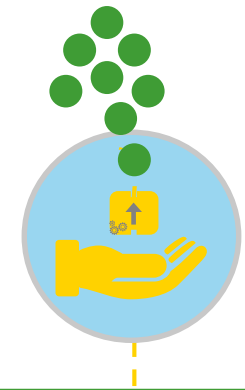


Blockchain is based on a distributed network, with no one centralised controlling entity enabling multiple use cases across all industries



TOKENISATION AND CRYPTOCURRENCY

Verified transactions can involve cryptocurrency contracts as a medium of exchange or tokens to reward behaviour and engender loyalty.



Supply Chain Sustainability and Resilience

Cryptocurrency is created and secured electronically in the blockchain.

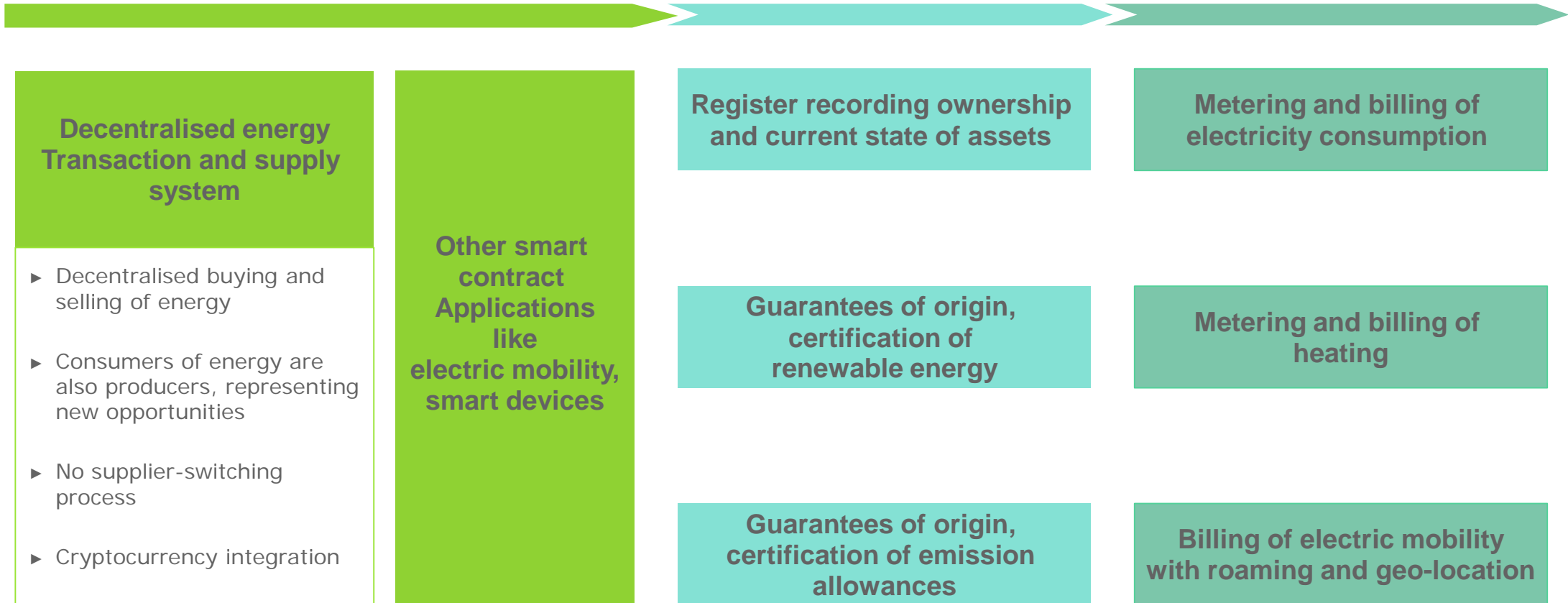
Encryption techniques are used to control and create units of exchange and to verify the funds.

Summary use cases within the energy sector

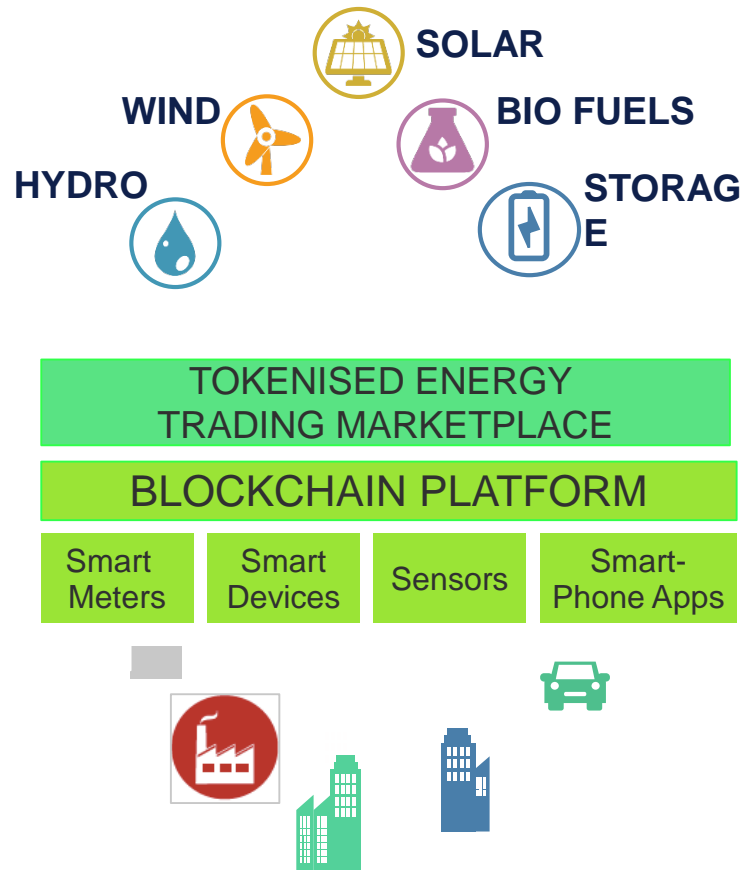
Applications with a focus on transactions and smart contracts enabling automated execution of contracts

Applications with a focus on documentation of ownership

Applications with a focus on distributed transaction records



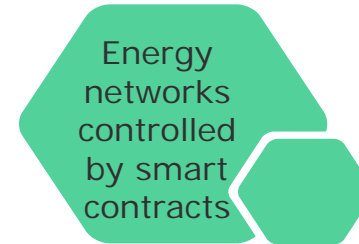
Distributed energy



Consumers of energy are also producers. Using blockchain technology it is possible to dispose of spare generation capacity by selling to other entities on the trading platform using energy exchange tokens

ENERGY SECTOR USE CASES

Supply and demand are balanced by smart contracts – balancing market, microgrids, virtual power plants, storage

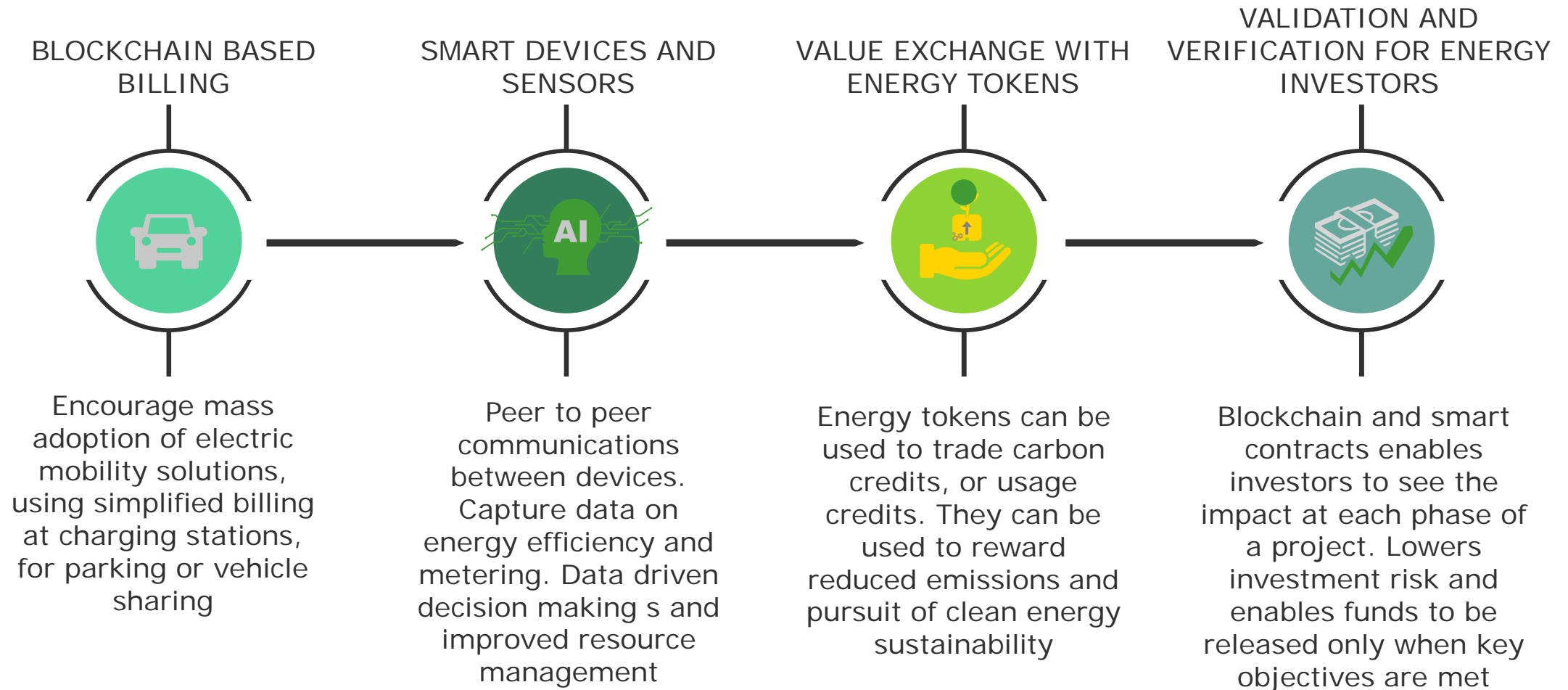


Emission allowances, renewable energy certificates, asset management

Transaction data is stored on the blockchain using the distributed ledger, with each party identified using digital identities

Crypto-tokens used interchangeably with traditional payment methods

Smart contracts and tokenisation





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